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Patient-Generated Subjective Global Assessment and classic anthropometry: comparison between the methods in detection of malnutrition among elderly with cancer

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Abstract

Introduction: **A comparative study of the various methods of nutritional assessment currently available in oncology are necessary to identify the most appropriate one, as well as the relationships that exist among the different instruments.**

Objective: **To compare the nutritional diagnosis obtained by the Patient-Generated Subjective Global Assessment (PG-SGA) with the objective anthropometric measurements in the elderly undergoing oncology treatment and to assess the concordance between the methods used in detecting malnutrition.**

Methods: **A cross-sectional study of the elderly, older than or equal to 60 years in age undergoing oncology treatment. The PG-SGA was performed and the anthropometric parameters including weight, height, Body Mass Index (BMI), arm circumference, arm muscle circumference, corrected arm muscle area, arm fat area, calf circumference, waist circumference, hip circumference, waist-hip ratio and triceps skinfold were evaluated. From a 24-hour recall the energy and macronutrient intakes were estimated.**

Results: **A total of 96 elderly patients were evaluated. The PG-SGA identified 29.2% with moderate malnutrition or suspected malnutrition and 14.6% with severe malnutrition. From among the elderly evaluated, 47.9% required critical nutritional intervention. The anthropometric parameters and the consumption of energy and macronutrients revealed significant differences based on the subjective PG-SGA classification. The prevalence of malnutrition ranged from 43.8% to 61.4%, depending upon the instrument used. The method most consistent with the diagnosis of malnutrition provided by the PG-SGA was the BMI (kappa = 0.54; CI: 0.347-0.648).**

Conclusions: **The PG-SGA showed a significant correlation with the anthropometric measurements and with**

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VALORACIÓN SUBJETIVA GLOBAL GENERADA POR EL PACIENTE Y LA ANTROPOMETRÍA CLÁSICA: COMPARACIÓN ENTRE LOS MÉTODOS EN LA DETECCIÓN DE DESNUTRICIÓN EN ANCIANOS CON CÁNCER

Resumen

Introducción: **Los estudios comparativos entre los métodos de evaluación nutricional en oncología son necesarios para identificar los medios más adecuados y las relaciones entre los diferentes instrumentos.**

Objetivos**: Comparar el diagnóstico nutricional obtenido por la Valoración Subjetiva Global-Generada por el Paciente (PG-SGA) con mediciones antropométricas objetivas en el tratamiento oncológico sometido ancianos y evaluar la concordancia entre los métodos de detección de la desnutrición.**

Métodos: **Estudio transversal de los ancianos con edad mayor o igual a 60 en tratamiento oncológico. El PG-SGA se realizó y evaluó los parámetros antropométricos: peso, talla, Índice de Masa Corporal (IMC), circunferencia del brazo, circunferencia muscular del brazo, área muscular del brazo corregida, brazo área de grasa, circunferencia de la pantorrilla, circunferencia de la cintura, circunferencia de la cadera, la cintura-cadera y pliegue tricipital. Desde un recordatorio de 24 horas se estimaron los consumos de energía y macronutrientes.**

Resultados: **Se evaluaron un total de 96 ancianos. El PG-SGA identificó 29,2% con desnutrición moderada o sospecha de la desnutrición y el 14,6% con desnutrición severa. De las personas mayores evaluados, el 47,9% necesitó una intervención nutricional crítico. Parámetros antropométricos y el consumo de energía y macronutrientes mostraron diferencias significativas en función de la clasificación subjetiva de la PG-SGA. Prevalencia de la desnutrición varió de 43,8% a 61,4%, en función del instrumento utilizado. El método más consistente con el diagnóstico de desnutrición proporcionada por el PG-SGA fue el índice de masa corporal (kappa = 0,54, IC: 0,347 hasta 0,648).**

Conclusiones: **El PG-SGA mostró una correlación significativa con las mediciones antropométricas y con el consumo de alimentos tanto para la clasificación cate-**

food consumption for both the categorical classification, as well as for the scoring system. Diagnosis of malnutrition showed variable prevalence depending upon the method used, and none were found equivalent to the PG-SGA.

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górica, así como para el sistema de puntuación. El diagnóstico de la malnutrición mostró prevalencia variable en función del método, y ninguno era equivalente a la PG-SGA.

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Palabras clave: *Estado nutricional. Desnutrición. Edad avanzada. Neoplasias.*

Abbreviations

AC: Arm circumference.
AFA: Arm fat area.
AMC: Arm muscle circumference.
ANOVA: Analysis of Variance.
BMI: Body Mass Index.
CAMA: Corrected arm muscle area.
CC: Calf circumference.
H: Height.
HC: Hip circumference.
Max: Maximum.
Min: Minimum.
PG-SGA: Patient-Generated Subjective Global Assessment.
SD: Standard deviation.
TSF: Triceps skinfold.
W: Weight.
WC: Waist circumference.
WHR: Waist-hip ratio.

Introduction

Malnutrition in cancer patients is a common, underestimated and multifactorial condition[1]. Its prevalence can extend to up to 85% of the cancer patients presenting physical, clinical and psychological implications[2]. The lowered tolerance to antineoplastic therapy, increased risk of complications, poor quality of life and higher mortality have been highlighted[3].

An assessment of their nutritional status allows for identification of those individuals in whom nutritional intervention is essential, in order to be able to start the treatment as early as is possible. Identification strategies to diagnose malnourished patients or those at nutritional risk are essential in order to implement effective nutritional support, reduce mortality and improve prognosis[4]. However, with regard to nutritional assessment, no method is currently available which can be considered the gold standard nor is there a consensus on which would be the best option, as well as the ideal cut-off points for assessment of the elderly with cancer.

Anthropometry is the universally employed method because it is inexpensive, noninvasive, and available to objectively assess the size, proportions and composition of the human body[5]. However, alterations that accompany aging, including those of loss of body water, decreased muscle mass, decreased bone mineral density and spinal deformities can compromise the accuracy of the anthropometric diagnosis[5,6]. In the case of the elderly cancer patients, the implications of the disease and treatment, including changes in cellular fluids (edema/dehydration) and the volume of solid tumors must also be taken into consideration, as they may mask the real weight and limit the use of anthropometry[2].

As an alternative to the classical anthropometric nutritional assessment available, the Patient-Generated Subjective Global Assessment (PG-SGA) was developed by Ottery (1996)[6]. This is a subjective and specific instrument for use in individuals with cancer, already translated and validated for the Brazilian population[7]. A comparison between the PG-SGA and the conventional Subjective Global Assessment indicated good correspondence, specificity and sensitivity between the subjective methods in several studies[8,9,10], although a few studies evaluated its direct relationship with the objective measures, especially in a sample composed exclusively of the elderly.

Thus, considering the various assessment proposals that currently exist, the advantages and limitations of each and the complexity involved in the nutritional diagnosis of the elderly, this study sought to assess the nutritional status in elderly patients with cancer, with emphasis on a comparison among the diagnoses provided by classical anthropometry and those obtained by the subjective assessment of the PG-SGA.

Methods

Study design and sample

This is a cross-sectional study, performed in a cancer treatment center in the municipality of Ponte Nova, Minas Gerais, Brazil. Data collection was done between July and November 2012, using the elderly individuals who came in for medical consultation/treatment.

This study focused on elderly patients, older than or equal to 60 years of age. This classification is based on the criteria of the Expert Group on Epidemiology and Aging of the World Health Organization (WHO), which defines the cutoff points of 60 and 65 years of age to define the elderly population in developing countries (such as Brazil) and developed countries, respectively[11]. The other inclusion criteria included the diagnosis of cancer confirmed by biopsy and having initiated cancer treatment, undergoing outpatient consultation and having signed the Statement of Informed Consent. Excluded from the study were the elderly who did not exhibit the clinical conditions in response to the interview.

Procedures

Nutritional status was assessed using the PG-SGA and traditional objective anthropometric methods. Initially, the PG-SGA technique was applied. Besides the nutritional categorical diagnosis of the 'well-nourished' (stage A), 'moderate malnutrition' or 'suspected malnutrition' (stage B) and 'severe malnutrition' (stage C), the PG-SGA allowed for the screening of nutritional intervention through a scoring system, which when less than or greater than nine points indicates the need for critical intervention[8].

This was followed by determining the anthropometric measurements. Weight (W) was measured on an electronic portable digital scale (Marte®) with a 200 kg capacity and a 0.05 kg sensitivity. The elderly subjects were positioned on the center of the scale in an upright position with arms extended laterally, barefoot and wearing light clothing[12].

Height (H) was measured using a portable vertical stadiometer, measured in centimeters and subdivided into millimeters (Alturexata®). The elderly were maintained in a standing position, with head in the Frankfurt plane, with shoulders, buttocks and heels touching the anthropometer pole, barefoot and with heels together[12].

Determination of the Waist Circumference (WC) was performed using a millimeter, non-elastic 1.5-m long tape, fitted to the body, without compression. The measurement was obtained at the height of the umbilicus, recorded at the time of expiration. The Hip Circumference (HC) was measured in the gluteal region corresponding to the largest bulge of the hips and buttocks, with the tape positioned perpendicular to the trunk without compressing the tissues. The Calf Circumference (CC) was evaluated with the elderly individual standing, with the tape placed in a horizontal position at the maximum circumference of the calf, touching the skin without compressing the underlying tissues. The Arm Circumference (AC) was measured at the midpoint between the acromion process of the scapula and the olecranon, on the non-dominant arm, with arms positioned parallel to the trunk[12,13].

The Triceps SkinFold (TSF) was measured with a caliper (Lange Skinfold Caliper®) with constant pressure of 10g/mm² and precision of 1.0 mm. The reading was performed on the rear portion of the non-dominant arm, at the mid-point at which the AC was measured, with the arm loose and held alongside the body. The measurements were performed in triplicate, where the final result was the average of the values[13]. All the measurements were performed by the same researcher.

From the measurements of W and H the Body Mass Index (BMI) was calculated: BMI (kg/m²) = weight (kg)/height (m)². From the AC and the TSF, the following measures were calculated (adopting $\pi = 3.1416$):

Arm Muscle Circumference (AMC), using the formula proposed by Gurney and Jelliffe (1973)[14]:

$$\text{AMC (cm)} = \text{AC (cm)} - \pi \times [\text{TSF (mm)} \div 10]$$

Arm Muscle Area (AMA), according to Frisancho (1981)[15]:

$$\text{AMA (cm}^2) = \frac{[\text{AC (cm)} - \pi\,\text{TSF (cm)}]^2}{4\pi}$$

Corrected Arm Muscle Area (CAMA), specific to each sex, obtained according to the equations proposed by Heymsfield et al., (1982)[16]:

Men:

$$\text{CAMA (cm}^2) = \frac{[\text{AC (cm)} - \pi \times \text{TSF (cm)}]^2}{4\pi} - 10$$

Women:

$$\text{CAMA (cm}^2) = \frac{[\text{AC (cm)} - \pi \times \text{TSF (cm)}]^2}{4\pi} - 6.5$$

Arm Fat Area (AFA), according to Frisancho (1981)[15]:

$$\text{AFA (cm}^2) = \frac{[\text{AC (cm)}]^2}{4\pi} - \frac{[\text{AC (cm)} - \pi\,\text{TSF (cm)}]^2}{4\pi}$$

Nutritional diagnosis

The elderly were classified based on the degree of malnutrition evident by using different measures, independent of the intensity of the commitment. The following criteria for the diagnosis of malnutrition were adopted:

PG-SGA stage B (moderately malnourished or suspected malnutrition) or C (severely malnourished);

B) BMI < 22 kg/m², according to the cut-off points established by Lipschitz (1994)[17];

C) CC < 31 cm, according to the World Health Organization[6];

D) AC < 90% adequacy, obtained according to the equation AC (%) = AC obtained (cm) x 100 / 50th percentile of the AC. The 50th percentile was used as a reference according to the age group and sex for the Brazilian population[18]. The diagnoses included the following categories: severe malnutrition < 70%, moderate malnutrition 70-80% and mild malnutrition 80-90%, according to the classification of Blackburn and Thornton (1979)[19].

E) AMC < 90% adequacy, obtained according to the equation AMC (%) = AMC obtained (cm) x 100

/ 50th percentile of the AMC. The 50th percentile was used as a reference according to the age group and sex for the Brazilian population[18]. The diagnosis included the following categories: severe malnutrition < 70%, moderate malnutrition 70-80% and mild malnutrition 80-90%, according to classification of Blackburn and Thornton (1979)[19].

F) CAMA < 25th percentile. The 25th percentile was used as a reference based on the age group and sex for the Brazilian population[18], including the categories: malnutrition < 10th percentile and risk of malnutrition ≥ 10th and < 25th percentile, according to Moleiro et al., (2008)[20].

G) TSF < 90% adequacy, obtained according to the equation TSF (%) = TSF obtained (cm) x 100 / 50th percentile of TSF. The 50th percentile was used as a reference according to the age group and sex for the Brazilian population[18]. The diagnosis included the following categories: severe malnutrition < 70%, moderate malnutrition 70-80% and mild malnutrition 80-90%, according to Blackburn and Thornton (1979)[19].

H) AFA < 25th percentile, according to Rombeau et al., (1989)[21], considering the 25th percentile according to the age and sex, as proposed by Menezes and Marucci (2007)[22].

Food consumption

The evaluation of the amount of energy and macronutrient consumed was performed by applying a 24-hour recall, utilizing a food photo album (Diet Pro, version 5i). The family members/caregivers assisted in providing and confirming the information.

Statistical analyses

The normality of the variables was evaluated by the Kolmogorov-Smirnov test. The correlation between the PG-SGA scores and the anthropometric measurements was verified using the Spearman correlation. To compare the anthropometric parameters and food consumption according to the PG-SGA categories, either the Analysis of Variance (ANOVA) was performed complemented by the Tukey test or the Kruskal–Wallis test, complemented by Dunn's multiple comparison test, based on the distribution of the variables. The difference in the frequencies of malnutrition by gender for the different assessment methods was assessed by the chi-square test. The kappa coefficient adjusted to prevalence was used to assess the nutritional diagnostic concordance among the methods. The interpretation used was the one proposed by Landis and Koch (1977)[23], where kappa from 0 to 0.19 indicates poor agreement, 0.20 to 0.39 little agreement, 0.40 to 0.59 moderate, 0.60 to 0.79 substantial and 0.81 to 1.00 excellent agreement. In all the analyses the significance level adopted for the rejection of the null hypothesis was 5%.

Statistical analyses were performed using the SPSS software (version 17.0), the comparison between the nutritional diagnosis of the PG-SGA and anthropometric and food consumption parameters via the SIGMA STAT program (version 2.03), the analysis of the prevalence-adjusted kappa by the WINPEPI software (version 11.4) and the analysis of diet composition in terms of energy and macronutrients in the Diet Pro software (version 5i).

Ethical aspects

The study protocol was approved by the Ethics Committee on Human Research of the Federal University of Viçosa (No. 069/2012/CEPH) and the elderly patients who agreed to participate signed a Statement of Informed Consent, in the presence of a family member/caregiver.

Results

A total number of 96 elderly were evaluated, among who 50% were female, with a mean age of 70.6 (SD = 7.8 years), ranging from 60 to 93. Tumors that occurred in the order of frequency were prostate (n=27, 27%), breast (n=22, 22%), lung (n=9, 9.4%), esophagus (n=9, 9.4%) and stomach (n=8, 8.3%). Among the elderly evaluated, 51% (n=49) had undergone cancer surgery, 35.4% (n=34) had received radiotherapy and 49% (n=47) had metastases.

According to the PG-SGA, 43.8% of those evaluated presented a certain degree of malnutrition (stage B or C) and 47.9% required critical nutritional intervention (Table I).

Comparisons between the objective anthropometric measures and subjective classification according to the PG-SGA (Table II) indicated statistically significant differences between the groups (stage A, stage B and stage C) for all the anthropometric parameters and for the absolute consumption of energy, carbohydrates, lipids and proteins. As for the consumption of macronutrients in relation to the percentage of the total energy intake, no differences were observed among the groups between the protein consumption in g/kg body weight and energy intake in kcal/kg body weight. We highlighted the variability of the consumption variable as revealed by the large difference between the minimum and maximum values.

The *post hoc* comparisons indicated that the BMI, AMC and HC decreased significantly in the groups (A > B > C). For weight, the CAMA, AC, CC, energy and protein consumption differences were identified in values between categories A (well nourished) and C (severe malnutrition) (A > C), but not between B (moderate malnutrition/risk of malnutrition) and C. For AFA, TSF, consumption of carbohydrates and lipids, differences were identified between stages A and C (A > C).

Table I
Nutritional status and Patient-Generated Subjective Global Assessment score of elderly undergoing oncology treatment. Ponte Nova, Brazil, 2012

Patient-Generated Subjective Global Assessment	*n*	*%*
Nutritional diagnosis		
Well-nourished (stage A)	54	56.2
Moderate or suspected malnutrition (stage B)	28	29.2
Severe malnutrition (stage C)	14	14.6
Nutritional Intervention	w	
No intervention required (0-1 point)	3	3.1
Require nutrition education with patient and family (2-3 points)	8	8.4
Require nutritional intervention (4-8 points)	39	40.6
Require critical nutrition intervention and management of symptoms (≥ 9 points)	46	47.9

Table II
Anthropometric and food intake variables of elderly undergoing oncology treatment according to nutritional diagnosis by Patient-Generated Subjective Global Assessment. Ponte Nova, Brazil, 2012

Variable	*stage A (n=54)*	*stage B (n=28)*	*stage C (n=14)*	*p*
	Mean (SD)[1] or Median (min-max)[2]	*Mean (SD)[1] or Median (min-max)[2]*	*Mean (SD)[1] or Median (min-max)[2]*	
Anthropometry				
Weight	68.35 (11.82)[a]	58.10 (11.71)[b]	50.56 (13.55)[b]	**<0.001***
BMI	26.98 (4.76)[a]	23.48 (4.46)[b]	19.65 (4.45)[c]	**<0.001***
AC	29.50 (19.0 - 41.5)[a]	26.50 (19.2-38.0)[b]	21.250 (18.0-33.0)[b]	**<0.001****
AMC	23.84 (2.33)[a]	22.12 (2.70)[b]	19.97 (3.55)[c]	**<0.001***
CAMA	37.12 (8.80)[a]	31.52 (10.60)[b]	24.44 (11.88)[b]	**<0.001***
AFA	20.93 (3.67 - 71.87)[a]	14.94 (4.37-44.09)[a.b]	7.51 (2.62-33.36)[b]	**<0.001****
CC	35.50 (29.0-45.5)[a]	32.50 (23.5-40.0)[b]	29.25 (20.0-38.0)[b]	**<0.001****
WC	96.11 (10.71)[a]	90.19 (11.34)[a]	78.00 (10.58)[b]	**<0.001***
HC	99.97 (9.15)[a]	93.42 (9.43)[b]	83.80 (7.95)[c]	**<0.001***
TSF	15.00 (4.00-41.00)[a]	12.50 (4.00-29.67)[a.b]	7.50 (3.00-22.67)[b]	**0.001***
Food intake				
Energy (kcal)	1440.90 (409.43-3532.63)[a]	1084.68 (447.13-2762.86)[b]	866.05 (435.87-2526.57)[b]	**<0.001****
kcal/kg body weight	26.26 (5.94-74.84)	20.94 (7.58-53.23)	15.10 (6.49-57.03)	0.387
Carbohydrates (g)	190.15 (57.82-613.93)[a]	157.33 (65.19-415.66)[a.b]	101.70 (67.00-409.41)[b]	**0.003****
Carbohydrates (%EI)	56.65 (17.87-79.43)	58.40 (37.16-76.92)	55.38 (43.45-67.26)	0.648
Proteins (g)	60.68 (19.00-158.54)[a]	50.50 (14.27-128.75)[b]	33.31 (14.21-109.19)[b]	**0.006****
Proteins (%EI)	16.40 (9.41-34.39)	15.16 (11.08-27.82)	17.48 (9.15-29.77)	0.765
Protein(g)/kg body weight	0.90 (0.32-2.43)	0.79 (0.25-2.48)	0.77 (0.20-2.46)	0.621
Lipids (g)	46.66 (2.58-164.36)[a]	33.28 (7.80-81.80)[a.b]	27.11 (11.79-55.74)[b]	**0.003****
Lipids (%EI)	28.04 (5.67-54.00)	27.59 (12.44-45.83)	27.15 (14.99-33.05)	0.840

SD: standard-deviation; min: minimum; max: maximum; BMI: Body Mass Index (kg/m^2); AC: Arm Circumference (cm); AMC: Arm Muscle Circumference (cm); CAMA: Corrected Arm Muscle Area (cm^2); AFA: Arm Fat Area (cm^2); CC: Calf Circumference (cm); WC: Waist Circumference (cm); HC: Hip Circumference (cm); TSF: Triceps SkinFold (mm).
[1]For variables with normal distribution; [2]For variables without normal distribution.
% EI: Percentual of total energy intake.
*Analysis of Variance (ANOVA), complemented by the Tukey test. **Kruskal-Wallis, complemented by Dunn's multiple comparisons test.
[a,b,c] Values followed by different letters differed from each other (p<0.05). Where there was no difference the letter was omitted.

Table III
Correlation among the Patient-Generated Subjective Global Assessment score and anthropometric and dietary variables of elderly undergoing oncology treatment. Ponte Nova, Brazil, 2012

Variables	*ρ[1]*	*p*	*CI (95%)*
Anthropometry			
Weight (kg)	-0.371	<0.001	(-0.558 – -0.183)
Body mass index(kg/m²)	-0.315	0.002	(-0.506 – -0.123)
Arm circumference (cm)	-0.260	0.011	(-0.455 – -0.065)
Arm muscle circumference (cm)	-0.192	0.061	(-0.390 – 0.006)
Arm muscle area (cm²)	-0.192	0.061	(-0.390 – 0.006)
Corrected arm muscle area (cm²)	-0.191	0.062	(-0.389 – 0.007)
Arm fat area (cm²)	-0.227	0.026	(-0.424 – -0.030)
Calf circumference (cm)	-0.325	0.001	(-0.516 – -0.134)
Waist circumference (cm)	-0.185	0.082	(-0.384 – 0.014)
Hip circumference (cm)	-0.307	0.003	(-0.499 – -0.115)
Triceps skinfold (mm)	-0.200	0.051	(-0.398 – -0.002)
Food intake			
Energy (kcal)	-0.631	<0.001	(-0.787 – -0.474)
Carbohydrates (g)	-0.515	<0.001	(-0.688 – -0.341)
Proteins (g)	-0.541	<0.001	(-0.711 – -0.370)
Lipids (g)	-0.598	<0.001	(-0.760 – -0.435)

[1]Spearman's correlation coefficient.
CI 95%: 95% Confidence Interval.

For WC, the difference between stages A and C (A > C) and between C and B (B > C) were observed. Although it is a subjective method, nutritional diagnosis by the PG-SGA showed a good relationship with the classical objective measures of the nutritional status among the elderly, especially among stages A and C, with significantly lower values for anthropometric parameters and food consumption in the last stage.

The PG-SGA score showed a significant inverse correlation for weight, body mass index, arm circumference, arm fat area, calf circumference, hip circumference, and intake of energy, carbohydrates, proteins and lipids (as shown in Table III). Thus, the higher scores in the PG-SGA, which indicated greater need for nutritional intervention, even with the variable magnitude, were associated with a reduced dietary intake and lower anthropometric values for 6 of the 12 anthropometric parameters evaluated.

The prevalence of malnutrition in the elderly determined by the PG-SGA was 43.8%, ranging from 24% (as determined by the CC) to 61.4% (as determined by the TSF) (Fig. 1). A comparison of the frequency of malnutrition among the sexes by different methods indicated a significant difference when the diagnosis was obtained using the AMA and CAMA, where a higher incidence of malnutrition was observed in males.

A statistically significant correlation was identified between the diagnosis of malnutrition provided by the PG-SGA and anthropometric measures. The highest values obtained from the concordance analysis (kappa) were observed for the BMI, AFA and CC, which showed moderate agreement with the diagnosis of the PG-SGA and observed agreements of 77.1%, 75% and 71.9%, respectively. The other parameters showed weak concordance, although they were statistically significant (Table IV).

All the elderly patients were able to fill the PG-SGA without assistance. Only two did not remember their earlier weight from the previous month. As the PG-SGA includes an alternative to this issue (to assess the weight six months prior), all candidates answered the questionnaire in full. The elderly neither showed nor reported any difficulty in understanding the questions posed.

Discussion

According to the PG-SGA, 43.8% of the elderly possessed some degree of malnutrition and 88.5% required nutritional intervention, whereas in 47.9% critical intervention was necessary. These results are consistent with the results of other studies, which, when

Table IV
Concordance among the malnutrition diagnosis by the Patient-Generated Subjective Global Assessment and anthropometric parameters of elderly undergoing oncology treatment. Ponte Nova, Brazil, 2012

Parameters	*Observed concordance (%)*	*Kappa*	*p*	*CI (95%)*	*Kappa adjusted by prevalence*
BMI	77.1	0.516	**0.000**	0.347 - 0.684	0.54
CC	71.9	0.398	**0.000**	0.225 - 0.570	0.44
TSF	67.7	0.372	**0.000**	0.199 - 0.544	0.35
AMC	66.7	0.312	**0.002**	0.121 - 0.502	0.33
AC	67.7	0.346	**0.001**	0.157 - 0.534	0.35
AMA and CAMA	65.6	0.292	**0.004**	0.099 - 0.484	0.31
AFA	75.0	0.481	**0.000**	0.304 - 0.657	0.50

BMI: Body Mass Index; CC: Calf Circumference; TSF: Triceps SkinFold; AMC: Arm Muscle Circumference; AC: Arm Circumference; AMA: Arm Muscle Area; CAMA: Corrected Arm Muscle Area; AFA: Arm Fat Area. CI 95%: 95% Confidence Interval.

using the same instrument, found a prevalence of malnutrition ranging from 43.4%[23] to 58.4%[24] and the critical need for nutritional intervention between 42.4%[25] and 59.5%[26]. In the study conducted by Segura et al., (2005)[27] in a sample composed of 781 cancer patients, 52% were identified with some degree of malnutrition and 97.6% required some counseling/nutritional intervention. Thus, it was found that even individuals classified as 'well nourished' by the PG-SGA may require intervention, corroborating the studies of Colling et al., (2012)[28] and Mota et al., (2009)[9]. In the present study, when considering only the elderly classified as 'well nourished' by the PG-SGA (stage A), 79.6% presented a need for some type of nutritional intervention and in 20.3% critical intervention was necessary. The results confirm and reiterate the continued need for nutritional care in individuals with cancer, especially in those individuals classified as 'well nourished'. In this sense, the score provided by the PG-SGA presents an additional advantage compared with the objective methods.

Application of the first part of the PG-SGA using the interview format may be considered a good alternative for use in the elderly, particularly for those with minimal education and visual difficulties. It is suggested that among the elderly, the first part of the

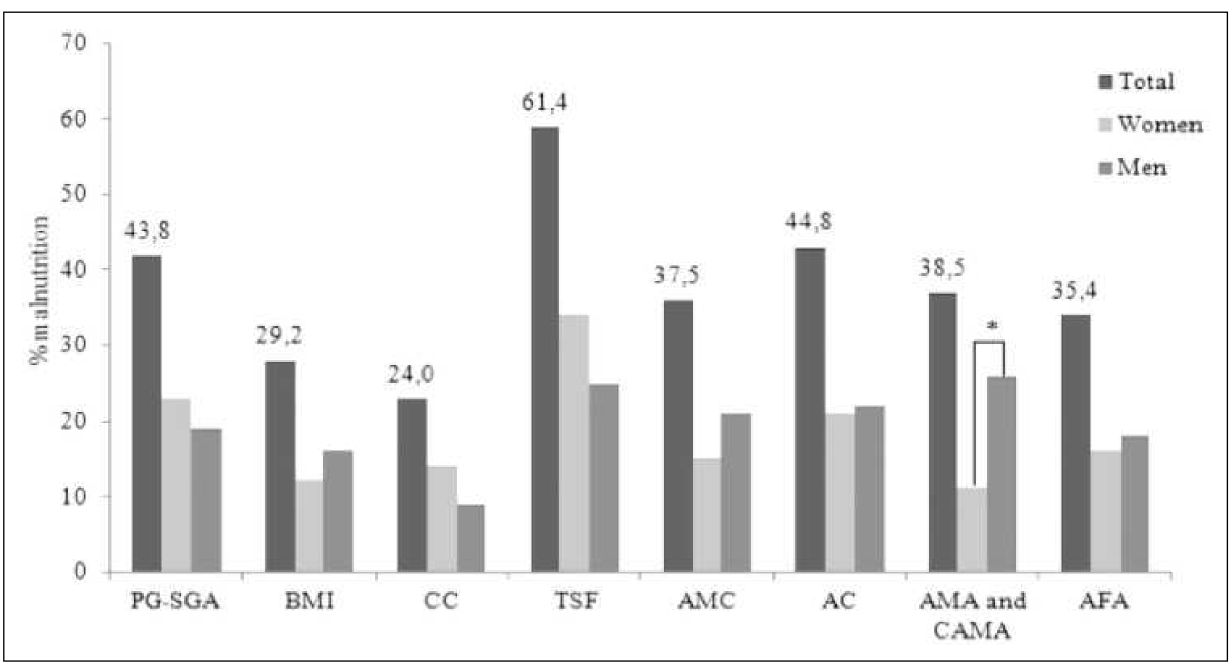

Fig. 1.—Prevalence of malnutrition in elderly undergoing oncology treatment, in the total sample and by sex, according to the different methods. Ponte Nova, Brazil, 2012.
PG-SGA: Patient-Generated Subjective Global Assessment; BMI: Body Mass Index; CC: Calf Circumference; TSF: Triceps SkinFold; AMC: Arm Muscle Circumference; AC: Arm Circumference; AMA: Arm Muscle Area; CAMA: Corrected Arm Muscle Area; AFA: Arm Fat Area.
** p<0.05 in the chi-square test.*

instrument be applied as an interview. In our study, the participants had no difficulty in answering the questions, suggesting the applicability of this method in the elderly, regardless of the educational level and age. Further studies using larger sample sizes should allow the stratification analyses by age and educational level, which may contribute towards confirmation of the validity of this method.

Categorical classification of the PG-SGA showed good relationship with the parameters evaluated, to the extent that the ratings of moderate or suspected malnutrition (stage B), and especially those of severe malnutrition (stage C), were accompanied by a significant decrease in the anthropometric measures and consumption variables. With weighted methodological differences in the study of Ravasco et al., (2003)[29], who used the PG-SGA and a 24-hour recall in 205 adult and elderly patients with cancer, differences were also observed in the food intake according to the subjective classification of nutritional status. The researchers observed an energy consumption lower than 955 kcal in subjects with severe malnutrition, slightly higher than the median found for this group (stage C) in the present study, which was 866 kcal. The other categories (stages A and B) showed significantly higher consumptions.

Kwang and Kandiah (2010)[30], when assessing the adult and elderly patients with advanced cancer, also observed clear relationships between the PG-SGA and anthropometric measurements. A significant inverse correlation was observed between the PG-SGA score and the TSF measurements ($r = -0.32$), AC ($r = -0.32$), AMC ($r = -0.26$) and BMI ($r = -0.29$) ($p<0.05$). In the present study, with a sample composed exclusively of elderly individuals with cancer, a significant inverse correlation with similar association strength was observed for weight ($\rho = -0.37$), BMI ($\rho = -0.315$), WC ($\rho = -0.26$), AFA ($\rho = -0.23$), CC ($\rho = -0.32$) and HC ($\rho = -0.30$) ($p<0.05$). Thus, a higher score provided by the subjective instrument, indicative of greater nutritional risk and greater need for intervention is associated with the lower anthropometric measures related to the body mass, muscle tissue and fat reserves. According to these authors, the PG-SGA is equally informative regarding the classical objective indicators and is recommended for cancer patients undergoing palliative care. The results indicate that this association is also valid for the nutritional evaluation of the elderly outpatients.

A higher incidence of malnutrition was observed when using the TSF (61.5%) and the lowest was recorded while using the CC (24%). Ulsenheimer et al., (2007)[31], on using different indicators for the assessment of nutritional status in adults and the elderly with cancer, also identified a great discrepancy in the prevalence of malnutrition depending upon the method used. The incidence of malnutrition ranged from 5.5%, when using the BMI, to 66.7%, according to diagnosis by the TSF; where the incidence of malnutrition by the PG-SGA was 50% and 38.9% for the AC and 16.7% for the AMC. In the present study, these percentages corresponded to 43.8%, 44.8% and 37.5% of those evaluated, respectively. It must be considered that the cutoffs and percentile Tables used as reference for the classification of nutritional status were not developed for cancer patients, which may compromise and limit the diagnosis.

If, for objective measurements, a significant correlation was identified with the PG-SGA along with differences according to the categorical classification, the concordance between the diagnosis of malnutrition by the PG-SGA with the objective methods was variable (from 65.6% to 77.1% depending on the method used), with the higher concordance being observed compared with the diagnosis obtained by the BMI (kappa=0.516; $p < 0.001$). A similar result was obtained by Ramos Chaves et al., (2010)[32], who also observed a concurrence between the PG-SGA and BMI with the same magnitude (kappa=0.52; $p < 0.01$) in a study involving 450 adult and elderly patients with cancer. The authors consider that the two methods are complementary: the BMI to classify overweight individuals and the PG-SGA to identify the malnourished patients, those at risk for malnutrition and the factors that most impact nutritional depletion.

The assessment of the nutritional status unfortunately boasts no gold standard for the diagnosis of nutritional disorders and there is also no ideal indicator which can on its own merit enable an accurate assessment of the nutritional state[33]. According to Pinho et al., (2004)[34], the use of isolated anthropometric measurements produces questionable results, given the limitations inherent in the methods, which must be supplemented by the association of different indicators. Grouping and interpreting these indicators together poses a major challenge for the science of nutrition.

According to Acuña and Cruz (2004)[35], the best method depends on the objectives of the evaluation. Considering the results obtained in the present study, the information extracted by the PG-SGA and the possibility that it indicates, in addition to a nutritional diagnosis, the need for nutritional intervention, confirms its recommendation as the preferred method for the identification of malnutrition in the elderly patients with cancer. If the main focus is the identification of excess weight and characterization of body composition, classical anthropometric measures will assume an important role in nutritional diagnosis, despite the limitations already presented.

Early detection of nutritional disorders, by malnutrition or excess weight, allows that primary nutritional intervention is performed in an attempt to minimize or prevent complications through corrective and preventive measures. In light of this information, the awareness of the nutritionists regarding the methods available, their indications, limitations and possibilities in nutritional management becomes crucial, particularly in individuals with cancer.

Conclusions

Based on the results presented, it was concluded that: 1) the score obtained by the PG-SGA has a good relationship with the anthropometric measurements and absolute food intake in the elderly; 2) The diagnosis of malnutrition by the PG-SGA shows variable concordance among the different methods and the present study revealed a higher magnitude with the BMI, CC and the AFA; 3) No single method was found to be equivalent to the PG-SGA for identifying individuals at nutritional risk.

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